Canadian Agri-Science Cluster for Horticulture 3

Update to Industry

2018-2019

Activity title: Late blight: Tracking pathogen strains and their characteristics
Name of Lead Researcher: Rick Peters, Agriculture and Agri-Food Canada (AAFC), Charlottetown, PE
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Activity Objectives (as per approved workplan): The overall objectives of the project are to track the distribution of strains of the late blight pathogen in Canada, determine various important biological characteristics of isolated strains including fungicide sensitivity, with the overall aim of improving disease management and economic returns. The specific objectives of this project are: **Sub-activity 1.1 Tracking potato strains of *P. infestans* in Canada** To identify strains of *Phytophthora infestans* causing late blight of potato in production areas across Canada and to develop a map showing the distribution of strains in this country. **Sub-activity 1.2 Characterization of novel strains including host/cultivar preference, environmental triggers, fungicide sensitivities, and control options** To assess novel late blight pathogen strains in Canada for their ability to cause disease in above and below-ground tissues of solanaceous plants, and to determine their sensitivity to registered and novel fungicides as well as the optimal environments for infection, spore production and survival (with the aim of understanding the impact of climate change on late blight pathogen population dynamics).

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Research Progress to Date:

Sub-activity 1.1 Tracking potato strains of *P. infestans* in Canada

During the 2018 field season, late blight was most prominent in Ontario and British Columbia, and was found in both potato and tomato crops. No late blight was reported from any other production region in Canada in 2018, largely due to the hot, dry weather that predominated in much of the country.

Samples of infected potato and tomato tissue from Ontario were collected and sent to AAFC-Charlottetown for subsequent pathogen isolation and analysis. In total, 11 tissue samples were received that yielded 21 pure cultures of the pathogen. In BC, late blight symptoms on potato were found in late September on a few potato farms in the Delta region. The disease was observed in two potato cultivars 'Melody' and 'Sieglinde'. As well, tomato community gardens in five different locations of the Fraser Valley were monitored in late September and October. Late blight symptoms were found in tomato plants in three community gardens. A total of 27 isolates of *P. infestans* were recovered from infected tomatoes from three locations. Seven isolates of *P. infestans* were isolated from potatoes from the Delta region. All isolates were maintained in pure culture and also placed in storage for downstream studies. As well, isolates were shared between AAFC – Charlottetown and AAFC – Agassiz for further characterization work at each location.

At AAFC – Charlottetown, pathogen isolates collected from 2018 were assessed for mating type, metalaxyl-m (Ridomil) sensitivity and pathogen strain. Isolates from potato and tomato from Ontario were of the A1 mating type, and either sensitive or moderately-resistant to Ridomil. Further molecular work identified the Ontario strain as US-23. This has become the most common strain of the late blight pathogen in Canada in recent years.

Isolates from BC, by contrast, were much more variable. Both A1 and A2 mating type isolates were identified and responses of isolates to exposure to Ridomil were largely moderately to highly resistant. Molecular analysis also revealed that several strains were present. Further confirmation of strain identity is on-going at AAFC – Agassiz.

Results would indicate that US-23 caused late blight in Ontario, but the more diverse collection of pathogen isolates from BC warrants a more in depth analysis to determine what type of strains are present and if any of them may be new ones. We also hope to determine if a sexually reproducing population exists that is generating this variation or whether other factors are at play. Having multiple strains in a production area will complicate the recommended control measures for late blight in that area. This work will be carried out in the coming months.

Sub-activity 1.2 Characterization of novel strains including host/cultivar preference, environmental triggers, fungicide sensitivities, and control options

In PEI, various tomato hosts including varieties with various resistance genes for late blight were challenged with different strains of the pathogen in a humid chamber created in a greenhouse environment. In Manitoba, both tomato and potato tissues were challenged, including potato tubers of different cultivars. In BC, preliminary experiments were conducted to assess isolate pathogenicity using potato tubers in a growth chamber.

Results so far indicate that late blight pathogen strains or genotypes vary widely in their ability to cause disease on host tissues. For example, US-23 is very aggressive on tomato foliage and fruit, but less aggressive on potato foliage. US-24 is able to infect both potato and tomato foliage similarly, while US-8 is largely adapted to potato in terms of disease expression. However, all genotypes can cause disease in potato tubers. Host varieties vary in their response to infection with the different genotypes, and tomatoes with known resistance genes for late blight (ie, Defiant, Mountain Magic, Mountain Merit) have been shown to be quite resistant to disease development caused by the new pathogen strains. Therefore, we have been encouraging their use in home gardens across Canada.

At AAFC – Agassiz, pathogen growth of various genotypes at different temperature regimes is being evaluated using Thermal gradient plate technology. Currently, 10 isolates from tomato and potato are being evaluated for their ability to produce spores and their growth rates at different very tightly controlled, temperature regimes. This work is on-going.

Fungicide sensitivity work, using in vitro agar assays, was largely restricted to metalaxyl-m sensitivity in 2018. However, this work will be expanded in 2019 to include many commonly used and novel fungicides.

Extension Activities (presentations to growers, articles, poster presentations, etc.):

Presentations

January 24-26, 2019. Pacific Agriculture Show, Tradex Exhibition Centre, Abbotsford, BC
Horticultural Growers' Short Course, Lower Mainland Horticulture Improvement Association
Invited Presentation: Burlakoti, R. and R.D. Peters, Late blight in BC and across Canada.

February 20-21, 2019. Ontario Fruit and Vegetable Convention, Scotiabank Convention Centre, Niagara Falls, ON
Presentation: Trueman, C. and R.D. Peters, Lessons for late blight in field tomatoes

Conference Proceedings

Burlakoti, R. R., and Peters. R. 2019. Late blight in BC and across Canada. In: Kabaluk, T. and Frey, L (Eds.) Proceedings of the Lower Mainland Horticulture Improvement Association 61th Annual Horticulture Growers' Short Course. Abbotsford, BC, January 24-26, 2019. ISSN 2560-7561. Pages 96-98.

Abstracts

Peters, R.D., K.I. Al-Mughrabi, F. Daayf, A. MacPhail, and L.M. Kawchuk. 2018. Population dynamics of the late blight pathogen in Canada for 2017. Phytopathology 108: S1.88-S1.89.

Peters, R.D., K.I. Al-Mughrabi, F. Daayf, A. MacPhail, and L.M. Kawchuk. 2019. Fluctuating pathogen populations predicate the need for adjustment to potato late blight management strategies in Canada. Canadian Journal of Plant Pathology: submitted.

News Releases

Keeping tabs on late blight. Carolyn King for SpudSmart, Issues Ink. Pages 34-38 in SpudSmart, Vol. 16, No. 1, Winter 2019.

Early Outcomes (if any) or Challenges:

- US-23 caused late blight in potato and tomato in Ontario in 2018; this strain is A1 with some sensitivity to Ridomil but this sensitivity seems to be decreasing
- Late blight in BC in 2018 was caused by multiple strains still to be determined; both A1 and A2 mating types were present and the strains were resistant to Ridomil
- Pathogen strains vary in their aggressiveness on different hosts. US-23 is very aggressive on tomato foliage and fruit, but less aggressive on potato foliage. US-24 is able to infect both potato and tomato foliage similarly, while US-8 largely causes disease in potato. However, all genotypes can cause disease in potato tubers.
- Tomato varieties with resistance to late blight are effective at reducing disease and are encouraged to be used by home gardeners

Key Message(s):

The epidemiology of late blight has completely changed in Canada with the distribution and spread of new pathogen strains. Having multiple strains present in a growing region will complicate disease control. Many strains are resistant to Ridomil and we are working on discovering their sensitivity to other typical or new fungicide products registered for late blight control in Canada. Classic control measures, including disposal of culls, destruction of volunteer potatoes and the use of clean/treated potato seed are still critical. Encouraging home gardeners to grow late blight-resistant tomato varieties is also a valuable control strategy.

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